A New Model of Titan's Upper Atmospheric Structure Derived from Voyager UVS Observations

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Solar occultation and airglow data obtained by the Voyager 1 Ultraviolet Spectrometer (UVS) during the November 1980 flyby of Titan are the primary sources of information we have on Titan's upper atmosphere. Analysis of the occultation data yielded exospheric temperatures and number densities for N_2 and the primary hydrocarbons, while the airglow data were used to infer the various energy sources in the upper atmosphere. These data have since been the observational basis for photochemical and radiative transfer models of Titan's thermosphere.

Recently, however, discrepancies between the occultation and airglow data have been noted, and attempts to reconcile them have been unsuccessful. Because the structure of the upper atmosphere inferred from the solar occultation data is the basis for modeling of the airglow emissions, a reanalysis of the solar occultation data was deemed necessary.

We have developed a more sophisticated procedure than previously employed to reanalyze the solar occultation data. We utilize a Monte Carlo model of the UVS detector assembly and specially-designed observational sequences to understand better the nonlinear performance of the UVS when observing the sun. This, coupled with advances in occultation analysis techniques, allows us to more accurately infer the structure of Titan's upper atmosphere.

Preliminary results indicate that the hydrocarbon densities from the earlier analysis may be too high. This could affect both the upper boundary conditions for photochemical models as well as the opacity used in radiative transfer models. It is also in the direction necessary to resolve the discrepancies between the two UVS data sets. We will present detailed results of this work during the DPS meeting.

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